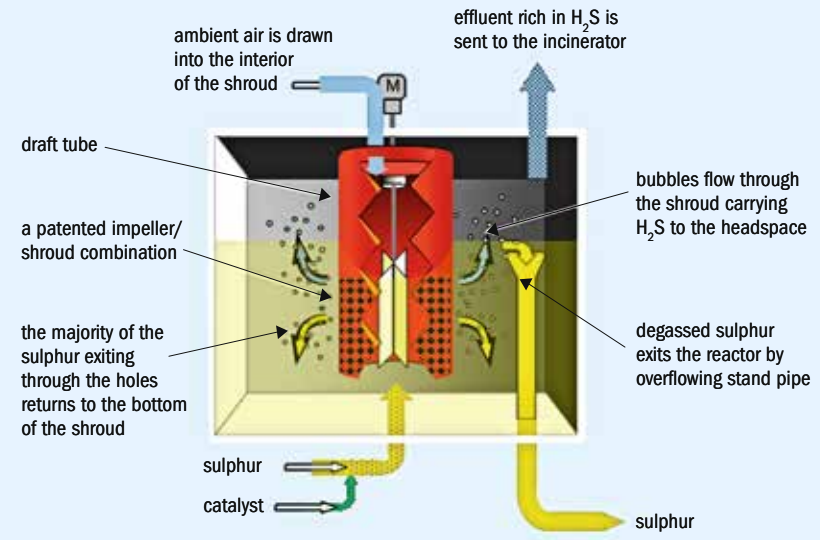
Fig 4: **HySpec plant at night**

PHOTO: ENERSUL

Fig 5: **HySpec flow chart**



Source: Enersul

HySpec™ degassing unit

Enersul Limited Partnership, located in Calgary, Alberta, Canada, developed the HySpec H_2S degassing system (Fig.5) in response to the sulphur industry's need for a compact and efficient sulphur degassing process. This process has been specifically designed to rapidly and economically reduce the H_2S concentration in liquid sulphur by utilising several concepts:

- aeration
- agitation
- introduction of a catalyst
- residence time.

The in-line, continuous flow design of the HySpec process eliminates the need for large molten sulphur pits typically required with traditional batch-type degassing systems. Additionally, the modular configuration of each train significantly minimises onsite construction and preparation work required at the field location.

The HySpec process uses gas-liquid contact inside a series of reactor cells and a select catalyst to aid in the rapid decomposition of hydrogen polysulphides (H_2S_x). HySpec reactor cells are fabricated with the processing equipment mounted on top. Each reactor consists of a closed cell with a centrally mounted impeller located inside a shroud. This shroud is a tube, which extends from the roof of the cell into the liquid. It is extensively perforated in the region submerged in the liquid sulphur. The reactor is a very efficient gas/liquid contacting device, yet remains simple in design. The number of reactor cells required depends on the liquid sulphur flow rate and input H_2S concentration.

Incoming molten sulphur, rich in H_2S, is pumped to the bottom of the first reactor cell, and flows over a stand-pipe into a drain leg connected to the inlet of the next reactor cell. Retention time within the cell is only minutes, as gravity flow is continuous through each subsequent cell.

The HySpec process utilises an amine catalyst to enable rapid decomposition of H_2S_X present in the sulphur to H_2S. An important factor in the selection of the catalyst is its volatility, which allows the chemical to evaporate and quickly exit the process along with the stripping air. The catalyst presently used in the HySpec is very active in encouraging H_2S_X decomposition; catalyst concentrations of less than 20 ppmw in the liquid sulphur are sufficient for degassing. A small amount of catalyst is pumped into all but the last reactor in a train to enhance conversion of the hydrogen polysulphides (H_2S_x) to hydrogen sulphide (H_2S). No catalyst is pumped into the last reactor in the train, as it is a

"purge" reactor, dedicated to the removal of the catalyst.

In operation, air is pulled in through a heated intake duct and then into the shroud assembly where it contacts the liquid sulphur, which is being agitated by the impeller. The impeller produces a large number of tiny bubbles by intense mixing and shearing in the impeller zone. The high shear rates generated by the impeller causes intimate contact and thorough mixing of air, sulphur, and catalyst. The catalyst causes the H_2S_x to quickly decompose to H_2S, and the H_2S is rapidly transferred from the liquid phase to the gaseous phase by the agitation and airflow.

The bubbles and sulphur then pass through the perforations in the shroud into a quieter region in the cell. The H_2S rich bubbles rise to the surface of the liquid and reconstitute in the headspace of the reactor cell. The H_2S rich effluent is drawn off by an exhaust fan to be incinerated (or treated in a scrubber). The sulphur is repeatedly drawn back into the shroud for exposure to the incoming ambient air.

Through the use of a blower on the exhaust side of the degassing train, ambient air is drawn into and through each reactor cell and is exhausted into ducting. The H_2S enriched effluent can then be routed to a suitable effluent treatment system such as a thermal oxidisation system. This design maintains a negative pressure in each reactor which prevents the fugitive release of H_2S gas.

The liquid sulphur can be pumped or gravity fed into the degasser. Exiting the degasser, the sulphur can be gravity fed to a small pump tank, drained to a holding pit or directly pumped to a degassed sulphur storage tank. Heating coils are installed in the bottom of each reactor to maintain the temperature in the liquid sulphur. All sulphur piping supplied with the HySpec system is steam jacketed.

HySpec has been designed for easy maintenance and safety. A flow-measuring device is used to monitor the airflow through each reactor and will activate an alarm and shut down the process should there be a disruption in airflow. The system is designed such that there will be no release of H_2S into the working area. In addition, all rotating equipment is supplied with safety guards which are removable for servicing.

The HySpec degassing system can be controlled using the existing gas plant DCS system or a standalone PLC. Each degassing train is skid-mounted and is supplied with all the instrumentation and components fully assembled. Field installation is relatively simple and requires hook-up of the sulphur, steam and exhaust lines to the client's interface for these components.

The commercial installations of the HySpec units in Alberta, Canada have been in continuous operation for over 20 years in a high H_2S containing liquid sulphur environment and have met all performance guarantees through this period.